REMARKS

At the time of the Office Action dated December 6, 2001, claims 1-18 and 20-49 were pending and rejected in this application.

Applicants note that the Information Disclosure Statement and cited art filed December 4, 2001, have not been acknowledged. Enclosed herewith are copies of the Information Disclosure Statement, PTO-1449 Form and stamped return postcard acknowledgement. Applicants hereby respectfully request that the Examiner clarify the record by acknowledging receipt of the Information Disclosure Statement filed December 4, 2001, and provide an appropriately initialed copy of the PTO-1449 form indicating consideration of the cited prior art.

Claims 1, 16, 24, 40, and 42 have been amended, and claims 44 and 44 have been cancelled. Care has been exercised to avoid the introduction of new matter. Specifically, claims 1, 24, 40, and 42 have been amended to include the limitation that the x-ray mirror emanates an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm, and this amendment to claims 1, 24, 40, and 42 finds adequate descriptive support throughout the originally filed disclosure as, for example, on page 9, lines 1-15 and in Fig. 7. The amendment to claim 16 merely restricts the type of material that will be used for the mirror, consistent with Applicants' prerogative to restrict an originally disclosed invention. **In re Johnson**, 558 F.2d 1008, 194 USPQ 187 (CCPA 1977). Applicants submit that the present Amendment does not generate any new matter issue.

Claims 1-2, 4, 14-17, 24-25, 27, and 37-39 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Itabashi, JP 11-014800, in view of Bearden et al. (hereinafter Bearden)

In the second enumerated paragraph of the statement of the rejection, the Examiner asserted that the combination of Itabashi and Bearden disclose the invention as claimed. The Examiner also stated that the limitation of "to utilize light at least having a component in wavelength ranging from 0.45 nm through 0.7 nm" found in claims 1 and 40 is interpreted as being directed to the manner in which the apparatus is used and, therefore, not given any patentable weight. This rejection is respectfully traversed.

Initially, Applicants note that claims 1 and 40 have been amended to delete the term "utilize" and the term --provide-- has been inserted therefor. As such, claims 1 and 40 now recite that light is provided in wavelength ranging from 0.45 nm through 0.7 nm. Furthermore, claims 1, 24, 40, and 42 have been amended to include the limitation that the X-ray mirror emanates an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm. Claim 16 has also been amended to remove ruthenium and palladium from the claimed limitations.

With regard to claim 16, none of the applied prior art discloses a material for the mirror that is selected from the group defined in amended claim 16. The applied prior art also does not disclose that X-ray exposure employs an X-ray wider in wavelength than conventional and thus reaching a range of short wavelength to achieve high resolution and high throughput, as addressed by the present invention, as recited in claim 16.

Itabashi describes that X-ray lithography employs an X-ray having a wavelength of 0.6 nm to 0.9 nm that is introduced incident on an X-ray mirror at a variable angle to change X-ray reflectance at the mirror. Itabashi also discloses controlling an exposed, outermost material of the mirror to locally change the intensity in reflection of an X-ray incident on the mirror at an invariable angle. In contrast, in the synchrotron radiation of the present invention, if an X-ray mirror receives an X-ray incident thereon at a angle changed to allow the mirror to emanate the

X-ray having a changed peak wavelength, the mirror can still emanate the X-ray in an invariable direction because the mirror can be controlled accordingly. Itabashi also does not disclose a range in which the X-ray used in the X-ray lithography peaks in wavelength.

Conventionally, X-ray lithography employs an X-ray peaking in wavelength around 0.8 nm (see for example J. Vac. Sci. Technol. B9(6), 1991) p. 3214, attached hereto). Therefore, Itabashi could not teach or suggest an x-ray mirror emanating an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm. Applicants, therefore, respectfully request withdrawal of the imposed rejection of claims 1-2, 4, 14-17, 24-25, 27, and 37-39 under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of Bearden.

Claims 3, 18 and 26 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of Bearden

In the second enumerated paragraph of the statement of the rejection, the Examiner asserted that the combination of Itabashi and Bearden disclose the invention as claimed. The Examiner also stated that, as a matter of design choice, one having ordinary skill in the art would have been motivated to include a cutting mirror that absorbs at least 90% of X-rays with wavelengths less than 0.3 nm because the general conditions of the claimed limitation is disclosed in the prior art. The Examiner is asserting that the disclosure of "tilting a mirror" discloses the general conditions of the claimed invention. This rejection is respectfully traversed.

The Examiner's reliance upon the "matter of design choice" rubric ignores the fact that the Examiner did not establish a basis in the prior art to support the asserted motivation. In this respect, Applicants would note that the Examiner did not identify whereabouts the prior art

discloses that the absorption of wavelengths less than 0.3 nm is an art-recognized result effective variable. See, **In re Rijckaert**, 9 F.3d 1531, 28 USPQ2d 1955 (Fed. Cir. 1993); **In re Yates**, 663 F.2d 1054, 211 USPQ 1149 (CCPA 1981); **In re Antonie**, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). The Examiner stated that "one would be motivated to differ the absorption factor to raise exposure luminous efficacy as shown by Itabashi." However, Applicants question how luminous efficacy would be raised when the cutting mirror absorbs at least 90% of X-rays with wavelengths less than 0.3 nm?

Furthermore, as stated in the specification, for example on page 43, lines 18-22, the absorption of short-wave x-rays can advantageously prevent deterioration of resolution resulting from generation of photoelectrons in a resist. This unexpected result is neither described nor suggested by the prior art. Applicants, therefore, respectfully submit that the imposed rejection of claims 3, 18, and 26 under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of the Bearden is not factually or legally viable and, hence, solicit withdrawal thereof.

Claims 5-8, 13, 20, 21, 28-31, 36, 40-43, and 46-49 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of Bearden, and further in view of Hasegawa, et al., U.S. Patent No. 6,219,400 (hereinafter Hasegawa)

In the third enumerated paragraph of the statement of the rejection, the Examiner asserted that one having ordinary skill in the art would have been motivated to modify the combination of Itabashi and Bearden with Hasegawa to arrive at the claimed invention. This rejection is respectfully traversed.

Hasegawa discloses means for maintaining a reflection invariably by positionally controlling an X-ray mirror when a source of light positionally varies. For example, if the source of light moves in a direction, then the mirror also moves parallel to the direction. Furthermore, if the source of light emits light at a different angle, then the mirror is angled differently to maintain an angle of reflection at the mirror. Thus, as the mirror of Hasegawa is controlled, the light in a strict sense emanates along a variable optic axis and in a variable direction. However, light in Hasegawa is rendered uniform in intensity for a region radiated that is larger than that which is in effect used for exposure and its thus not disadvantageous if light emanates in such a variable direction. Therefore, Hasegawa fails to disclose that if an X-ray mirror reflects light at a variable angle the mirror still emanates light along an invariably maintained optic axis. Accordingly, the proposed combination of references would not yield the claimed invention. **Uniroyal, Inc. v. Rudkin-Wiley Corp.**, 837 F.2d 1044, 5 USPQ2d 1434 (Fed. Cir. 1988). Applicants, therefore, respectfully submits that the imposed rejection of claims 5-8, 13, 20, 21, 28-31, 36, 40-43, and 46-49 under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of the Bearden and Hasegawa is not factually or legally viable and, hence, solicits withdrawal thereof.

Claims 9-10, 22-23, and 32-33 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of Bearden

In the fourth enumerated paragraph of the statement of the rejection, the Examiner asserted that the combination of Itabashi and Bearden disclose the invention as claimed.

Claims 9-10, 22-23 and 32-33 depend ultimately from independent claims 1, 16, and 24 and Applicants incorporate herein the arguments previously advanced in traversing the imposed rejection of claims 1, 16, and 24. Specifically, the applied prior art fails to teach or suggest an X-

ray mirror emanating an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm. Applicants, therefore, respectfully submit that the imposed rejection of claims 9-10, 22-23 and 32-33 under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of the Bearden is not factually or legally viable and, hence, solicit withdrawal thereof.

Claims 11-12 and 34-35 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of Bearden, and further in view of Reinecke, et al., EP 903638 A1 (hereinafter Reinecke)

In the fifth enumerated paragraph of the statement of the rejection, the Examiner asserted that one having ordinary skill in the art would have been motivated to modify the combination of Itabashi and Bearden with Reinecke to arrive at the claimed invention. This rejection is respectfully traversed.

Reinecke indicates a range of 0.1 nm to 10 nm as a range in wavelength of an X-ray for exposure. However, Reinecke discloses a technique relating to LIGA (Lithographie, Galvanoformung, Abformung) used to produce a so-called micromachine. Therefore, Reinecke discloses a technique very much different from the present invention. As such, one having ordinary skill in the art would not have been motivated to use Reinecke to modify Itabashi and Bearden. Applicants, therefore, respectfully submits that the imposed rejection of claims 11-12 and 34-35 under 35 U.S.C. § 103 for obviousness predicated upon Itabashi in view of the Bearden and Reinecke is not factually or legally viable and, hence, solicits withdrawal thereof.

Claims 44 and 45 are rejected under 35 U.S.C. § 103 for obviousness predicated upon Reinecke in view of Bearden

In the sixth enumerated paragraph of the statement of the rejection, the Examiner asserted that one having ordinary skill in the art would have been motivated to combine Reinecke with Bearden to arrive at the claimed invention. As claims 44 and 45 have been cancelled, the Examiner's rejection has been rendered moot.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

Applicants have made every effort to present claims which distinguish over the prior art, and it is believed that all claims are in condition for allowance. However, Applicants invite the Examiner to call the undersigned if it is believed that a telephonic interview would expedite the prosecution of the application to an allowance. Accordingly, and in view of the foregoing remarks, Applicants hereby respectfully request reconsideration and prompt allowance of the pending claims.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417, and please credit any excess fees to such deposit account.

Respectfully submitted,

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Version with markings to show changes made

IN THE CLAIMS:

Please cancel claims 44 and 45 in their entirety without prejudice or disclaimer of the subject matter and amend claims 1, 16, 24, 40 and 42 as follows:

1. (Twice Amended) An X-ray exposure apparatus comprising an X-ray mirror containing a material having an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm as to X-rays to [utilize] provide light at least having a component in wavelength ranging from 0.45 nm through 0.7 nm, and

the x-ray mirror emanates an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm.

16. (Twice Amended) An X-ray mirror containing one type of material for mirror selected from the group consisting of titanium, silver, [ruthenium, palladium,] and nitride thereof, a carbide thereof, a boride thereof, diamond, diamond-like carbon, and boron nitride, and

said X-ray mirror provides light at least having a component in wavelength ranging from 0.45nm through 0.7 nm.

24. (Twice Amended) An X-ray exposure method comprising:

an X-ray incidence step of making X-rays incident upon an X-ray mirror containing a material having an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm as to X-rays; and

an exposure step of performing exposure with X-rays outgoing from said X-ray mirror and at least having a component in wavelength ranging from 0.45 nm through 0.7 nm, and

the x-ray mirror emanates an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm.

40. (Twice Amended) A synchrotron radiation apparatus comprising a synchrotron radiation source and an X-ray mirror group including a plurality of X-ray mirrors upon which radiation outgoing from said synchrotron radiation source is incident, wherein

said X-ray mirrors contain a material having an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm as to X-rays,

the outgoing direction of said radiation outgoing from said synchrotron radiation source and the outgoing direction of reflected light outgoing from said X-ray mirror group are substantially identical, and

said X-ray mirror [is used to utilize] provides light at least having a component in wavelength ranging from 0.45nm through 0.7 nm, and

the x-ray mirror emanates an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm.

42. (Twice Amended) A synchrotron radiation method employing a synchrotron radiation apparatus comprising a synchrotron radiation source and an X-ray mirror group including a plurality of X-ray mirrors upon which radiation outgoing from said synchrotron radiation source is incident, said synchrotron radiation method comprising:

a radiation incidence step of making radiation outgoing from the synchrotron radiation source incident upon an X-ray mirror containing a material having an absorption edge only in a wavelength region other than 0.45 nm through 0.7 nm as to X-rays, and

a reflected light emitting step of emitting reflected light from said X-ray mirror group in a direction substantially identical to the outgoing direction of the radiation outgoing from said synchrotron radiation source, said reflected light at least having a component in wavelength ranging from 0.45 nm through 0.7 nm, and

the x-ray mirror emanates an X-ray having a peaked wavelength in a range from 0.45 nm to 0.7 nm.